Portraying the Earth
Chapter 2

What will we learn in this chapter

- The basic characteristics of maps, their capabilities and their limitations
- To describe the various ways the landscape can be portrayed
    - Map projections
    - Globes
    - Photographs
    - Remotely sensed imagery

The Nature of Maps

- A map is a two-dimensional representation of the Earth and the spatial distribution of selected phenomena– normally components of a landscape.
- Basic attributes of a map
    - Show direction, distance, size, and shape
        - Spatial relationships of features of the earth
- Maps usually have a special purpose

Map Scale

- The scale of a map gives the relationship between length measured on the map and corresponding actual distance on the ground.
- Scale types
    - **Graphic Map Scales** uses a line marked off in graduated distances.
    - **Fractional Map Scales** compares map distance with ground distance in a proportional fraction or ratio called a **representative fraction.**
    - **Verbal Map Scales or *word scales,*** state in words the ratio of the map scale length to the actual distance on the Earth's surface.

Large Scale and Small Scale

- Large Scale Maps.
    - Large representative fraction or the denominator is small. 1:10,000
    - See more detail in the map
    - Portrays a smaller section of the earth
- Small Scale Maps
    - Small representative fraction, or the denominator is large, 1:1,000,000
    - See less detail in the map
    - Portrays a large area of the earth

Map Essentials (Components of a Map)

- Title: short brief summary of map's contents
- Date: should be the date of the compilation of the data found on the map.
    - Can also be the date of the data found on the map
- Legend: information about the symbols colors, and such used to depict the features of the map

- Scale, if map is more than a pictogram. Scale can be either graphic, verbal, for fractional.

Map essentials, cont.

- Direction: a north arrow (top of the map, should be north). If there is a grid, there should still be a north arrow.
- Location: grid, such as latitude and longitude, to be used to locate features
- Data Source: source of the data found on the map
- Projection type: in what projection is the data on the map

Globes

- No substitute for depicting the earth
- The only thing changed in depicting the earth onto a globe is the size
- Shows comparative distances, sizes, and accurate directions.
- Represents without distortion, the spatial relationships of features of the earth
- Problem, because the globe will be set a very small scale (detail is lost)

Map Projections

- A system whereby the spherical surface of the earth is transformed to display on a flat surface.
- Three basic projection styles for the earth
  - Cylinder
  - Cone
  - Flat
- Using a globe inside the Earth with each style, the lines or features are transferred to the paper

Equivalence versus Conformality

- Equivalence Projection – equal area projection
  - The size ratio of any area on the map to the corresponding area on the ground is the same all over the map
  - Desirable because misleading impressions are avoided.
  - Difficulty to achieve on small-scale maps, to maintain proper areal relationships

Equivalence versus Conformality

- Conformal Projection – conformal relations
  - Proper angular relationships are maintained so that the shape of something on the map is the same as its shape on the Earth
  - Meridians and Parallels cross each other at right angles.
  - Most notable projection is probably the *Mercator* projection.
  - A *Robinson* projection is a compromise between a equivalence and conformality.

Projections

- Mercator, the most famous Projection
  - Developed in 1569 by Flemish geography and cartographer, Gerhardus Mercator.
  - Developed for use in navigation of ships
  - Advantage: shows *loxodromes or* ***Rhumb lines*** as straight lines.
  - Problem with the Mercator,
    - Extreme East-West distortion in higher latitudes
    - To compensate Mercator stretched the spacing north and south to compensate.
    - Allowed shapes to be reasonably accurate but proper size relationships distorted.

Projections, cont.

- The Plane projection – *azimuthal or zenithal projection.*
  - Obtained by projecting markings of the globe on a flat piece of paper that is tangent to one point of the globe
  - Used often in large scale maps or small areas of the globes
  - Usually is shown from either the North Pole or the South Pole

Projections, cont.

- The Conic Projection
  - Obtained by projecting the markings of the globe onto a cone wrapped tangent to or intersecting a portion of the globe
  - Normally the apex of the cone is positioned about a pole which means the circle of tangency coincides with a parallel.
  - Best suited for regions of east-west orientation in the mid latitudes.

Funky Projections

- Pseudocylindrical projection – elliptical or oval projection
- Football shape of usually the whole world
- Interrupted projections
  - Most famous – *Goode's interrupted homolosine projection*

Computer Cartography

- Using computers to create maps
  - Symap (first software used to make maps
    - 1965
  - Global Positioning Systems
  - Remote Sensing
  - Imagery
  - Multi-spectral Remote Sensing
  - Geographic Information Systems
- Widely used today

- Expanding industry

Isolines

- Portray the spatial distribution of some phenomenon on the earth
    - Isarithm, isogram, isopleth, and isometric lines are synonymous for our purposes
    - Most important to physical geography
        - Elevation Contour Line – depicts elevation
        - Isotherm – depicts equal temperature
        - Isobar – depicts equal atmospheric pressure
        - Isohyet – depicts equal quantities of precipitation
        - Isogonic line – depicts equal magnetic declination

Characteristics of Isolines

- Always closed lines- is line comes to the end of a map the line probably proceeds to the next area
- Represent gradations in quantity, never touch or cross one another
- Numerical difference between one isoline and another is an interval.
- Isolines close together indicate a steep gradient. those far apart indicate a gentle gradient.

Global Positioning System (GPS)

- A satellite based system for determining accurate positions on or near the Earth's surface.
- Developed in the 1970's for the military
- Based on 24 high-altitude satellites configured so that a minimum of 4 satellites are in view of any position on the Earth.
- Each satellite continuously transmits both identification and positioning information that can be picked up by receivers on Earth.
- Position determined through triangulation.

Remote Sensing

- **Any measurement or acquisition of information by a recording devise that is not in physical contact with the object under study-in this case the Earth.**
    - Satellite remote sensing
        - Imagery obtained from geosynchronous orbit satellites.
    - Aerial Photographs
        - Photographs taken from an elevated platform, such as a balloon, airplane or rocket.

- Photographs classified either oblique or vertical.

Imagery

Imagery

- Orthophoto Maps – multicolored, distortion-free photographic image maps.
  - All displacement caused by camera tilt or differences are removed.
  - Shows greater detail than a conventional map but retains the characteristic of a map
- Color or Near Infrared Sensing Imagery
  - Refers to the visible-light region of the electromagnetic spectrum
  - Near Infrared Color used to depict vegetation
- Thermal Infrared Sensing – depicts temperature

Mutispectral Remote Sensing

- Multispectral or Multiband – different regions of the electromagnetic spectrum
  - Landsat imagery
  - Launched in the 1970's and 1980's
    - Four spectral bands
- Earth Observing System (EOS)
  - Moderate Resolution Imagery Spectroradiometer (MODIS)
    - 36 spectral bands
- Radar and Sonar Sensing

Geographic Information Systems (GIS)

- Automated system for the capture, storage, retrieval, analysis, and display of spatial data.
- A GIS can manipulate rows and columns of tabular and links it to the spatial features it represents.
- All the features depicted in the GIS have a coordinate system that ties them to a coordinate system of the earth
- Knows where it is on the earth's surface
- Allows for the many layers of different features to be over-laid to form maps that can be used to make decisions.